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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Corrosion Inhibiting Packaging Material

We, CANADIAN TECHNICAL TAPE, LTD., a Canadian Corporation of 455 Cote Vertu, Montreal, Canada, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to corrosion inhibiting packaging material particularly for the use in preventing corrosion of metallic surfaces. The deterioration of metallic surfaces, especially those composed of ferrous metals, has been one of modern man's serious problems. The causes for this corrosive deterioration are manyfold, some are of a chemical, others of a physical, and still others even of a biological nature. Means to combat this destructive force have been and still are sought after.

In recent times vapor phase inhibitors have been developed which aid in preventing corrosion. These products are usually amine salts with a high vapour pressure. They are effective only in a confined space. The object to be protected must be packaged in a sealed box or carton or must be tightly wrapped. The vapor phase inhibitor is placed in the package along side the metallic object or is coated on the inside faces of the package. The inhibitor vaporizes and thus creates an anticorrosive atmosphere around the metallic object. U. S. patent No. 2,643,176, granted June 23, 1953, to Aaron Wachter and Nathan Stillman, and U. S. patent No. 2,717,843, granted Sept. 13th, 1955 to Aaron Wachter and Nathan Stillman, and others, teach us the use of such corrosion inhibiting papers. Two major shortcomings of these vapor phase inhibitor impregnated or coated papers are: (a) the need for over-wrap to reduce inhibitor loss, and (b) the need for additional packaging or sealing material.

The need for overwrap material is quite apparent. Since the inhibitor paper depends on its action on a very volatile amine salt, it becomes imperative to take all possible actions to minimize the loss of this volatile chemical. In practice, this requires overwraps, boxes, cartons, or sometimes more drastic protective means depending on storage conditions and duration.

Furthermore, since the inhibitor containing paper forms by no means a tight seal it must be taped, glued or in some other way fastened in order to prevent it from unwrapping.

It is an object of the present invention to provide a method for preserving the metal surfaces and in particular ferrous surfaces against corrosion without the necessity of having the source of the inhibitor within close proximity to those surfaces.

Another object of this invention is to provide a packaging material which will act as a carrier for a corrosion inhibitor. Other objects of this invention will become quite apparent from a study of the following detailed description and the cited examples.

According to the present invention there is provided a corrosion inhibiting packaging material comprising a flexible backing and a coating disposed upon said flexible backing, said coating containing a vapor phase corrosion inhibiting substance and having pressure sensitive adhesive characteristics.

Our new corrosion inhibiting packaging material preferably consists of: (A) a flexible backing, (B) an adhesive coating thereon, and (C) a corrosion inhibiting amine salt dispersed in the adhesive coating. The flexible backings may be chosen from a variety of papers, films, foils, or fabrics. Selection of proper flexible backing will be guided by many factors such as: the size and shape of objects to be packaged, storage and shipping conditions, storage or shipping duration, and others.

The preferred choice of adhesive is one which possesses pressure sensitive properties. This means that the packaging material can be sealed without the use of solvents or heat to activate the adhesive coating. The mere appli-

cation of minor pressure will effect the desired seal. It is furthermore preferred to employ an adhesive which will evince little or no adhesion to any surface save itself. Such an adhesive requires no release backing on the flexible packaging material and leaves no adhesive residues on the packaged metallic object. However, other types of adhesives may be used as well in the successful practice of this invention.

The corrosion inhibitor may be selected from among a large number of amine salts. Table I summarizes experiments designed to ascertain the relative effectiveness of various amine salts in preventing corrosion. Selection of the appropriate inhibitor is further aided by a study which is summarized in Table 2. The rates of vaporization determined, enable the formulator to select a product with a reasonable long shelf life. An intelligent appraisal of Table I together with Table 2 leads one to conclude that dicyclohexylamine benzoate is preferable to dicyclohexylamine nitrite.

TABLE I

Effect of Amine Salts Upon Corrosion of Immersed Test Panels

Test Solution Containing 5%	Per Cent Weight Change	Visual inspection after 24 hours immersion at 60° C.
Blank	—.02	badly corroded
Diethanolamine-nitrite	—.018	perfect
Diethylenetriamine-carbonate	—.07	dull spots
Dicyclohexylamine-oxalate	.04	uniform grey-green coating
Dicyclohexylamine-carbonate	—.003	dull
Dicyclohexylamine-nitrite	—.03	a few spots
Dicyclohexylamine-benzoate	—.015	perfect

TABLE 2

Rate of Vaporization of Amine Salts

Amine Salts	Per Cent Weight Change			
	0 min.	15 min.	75 min.	105 min.
Dicyclohexylamine-nitrite	100	51.4	41.0	38.9
Dicyclohexylamine-sulfate	100	89.8	88.4	88.1
Dicyclohexylamine-carbonate	100	3.2	2.1	—
Dicyclohexylamine-acetate	100	33.6	0	—
Dicyclohexylamine-benzoate	100	84.5	77.4	60.0
Dicyclohexylamine-citrate	100	89.4	83.0	76.2
Dicyclohexylamine-oxalate	100	99.2	98.3	—

The benzoate performs better than the nitrite on the corrosion emersion test and has a lower rate of vaporization. The benzoate should thus perform as well or better than the nitrite and last must longer. Smaller proportion of a faster acting, higher rate of vaporization, amine salt, may be employed as well.

As alternatives to the aforementioned amine-type vapor phase corrosion inhibitors, one may also utilize sulphur compounds, such as 2-nitrothiophene, 2, 5-dinitrothiophene, and others for this purpose. Another class of vapor-phase inhibitors suitable for the practice of the present invention comprises mixtures of an organic amide with an inorganic nitrite such as, sodium nitrite, potassium nitrite, calcium nitrite, and others.

Mixtures of the aforementioned vapor-phase inhibitors may be employed as well.

In the accompanying drawing, the single figure is a graph showing that the rate of vaporization of the corrosion inhibitor is retarded by incorporating same into the adhesive and this is an important advantageous feature of the invention in that the period of useful performance of the corrosion inhibitor is prolonged considerably.

To illustrate the invention we may cite several examples of formulations, which have been coated on flexible backing and have performed well as packaging materials designed to inhibit corrosion of metallic objects.

EXAMPLE No. 1

Dicyclohexylaminebenzoate	20 — 30 parts
Diethylamine	71/2 — 12 1/2 parts
Polyisobutylene	50 — 80 parts
Toluol	300 parts

The alkyl amine aids in the dispersion of the insoluble dicyclohexylamine benzoate and enhances the inhibiting properties of the salt. The preferred amine of this invention is butylamine. However, other primary as well as secondary amines may be employed. Good result has been obtained with ethylenediamine, diethylamine, dicyclohexylamine, diethylenetriamine, and others.

The polyisobutylene of formulations cited herein is that manufactured by Enjay Company under the trademark VISTANEX. The grades most suitable for this invention are VISTANEX L—80 and LMMS. It is preferable to employ mixtures of those, in which the L—80 is in a ratio of from 10+1 to 5+1 to that of the LMMS.

The proportion of solvent given herein is only as a guide line and must be adjusted to accommodate coating equipment and conditions.

EXAMPLE No. 2

Dicyclohexylamine benzoate	20 — 30 parts
Dicyclohexylamine acetate	0 — 5 parts
Butylamine	7 1/2 — 12 1/2 parts
Polyisobutylene	50 — 80 parts
Toluol	300 parts

This formula differs from the previous one in one respect only, namely the incorporation of dicyclohexylamine acetate. The reasons for this addition have been discussed in previous paragraphs.

EXAMPLE No. 3

Dicyclohexylamine benzoate	15 — 30 parts
Polyvinyl ether	70 — 85 parts
Toluol	300 parts

The polyvinyl ether employed in formula 3 was Lutanol M—40. However, other equivalent polyvinyl ethers may be employed as well.

WHAT WE CLAIM IS:—

1. A corrosion inhibiting packaging material comprising a flexible backing and a coating disposed upon said flexible backing, said coating containing a vapor-phase corrosion inhibiting substance and having pressure-sensitive adhesive characteristics.

2. A corrosion inhibiting packaging material according to Claim 1, in which the flexible backing is made of paper, plastic film, metal foil or textile material.

3. A corrosion inhibiting packaging material according to Claim 1 or Claim 2, in which the adhesive coating comprises polyisobutylene.

4. A corrosion inhibiting packaging material, according to Claim 1 or Claim 2, in which the adhesive coating comprises polyvinyl ethers.

5. A corrosion inhibiting packaging material according to Claim 1 or Claim 2, in which the corrosion inhibitor comprises an amine salt.

6. A corrosion inhibiting packaging material substantially as hereinbefore described in any of the examples.

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1048770 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

RATE OF VAPORIZATION
AT 100°C

□ DICYCLOHEXYLAMINENITRITE

△ POLYISOBUTYLENE
DICYCLOHEXYLAMINENITRITE

○ POLYISOBUTYLENE